Introduction and background
Reactivation of the Willunga Fault is responsible for one of Australia's prominent neotectonic features (Fig. 1) (Sandford, 2003). The Willunga Fault juxtaposes Cenozoic St. Vincent Basin sediments and Cretaceous-Miocene basement (Fig. 2), and is responsible for the reactivated deformation observed in this study. In highly porous rock, strain is vertically accommodated in areas of localized deformation resulting in reduced porosity and increased cohesion (Powell, 2002). The Willunga Fault comprises of at Sellicks Beach and Port Willunga contain deformation bands (Fig. 2), which are rarely documented in carbonate formations. This study aims to use deformation bands to elucidate the neotectonic history of the Port Willunga Formation. The overall goal is to develop a model to delineate the impact of deformation bands in sedimentary-hosted uranium mineralization focusing on structural analysis of brittle deformation features like fractures and deformation processes at Willunga fault. The overall goal is to develop a model to delineate the impact of deformation bands in sedimentary-hosted uranium mineralization focusing on structural analysis of brittle deformation features like fractures and deformation processes at Willunga fault.

Structural data from the formations adjacent to the Willunga Fault
We measured 440 fracture in the Heathendale Shale, which define four conjugate fracture sets through a combination of high-resolution imagery analysis and conventional grid methods. Using a more conventional grid method, we measured 221 deformation bands in the Port Willunga Formation, which define four neotectonic generations of deformation bands (Fig. 5). Deformation bands increase moving towards the Willunga Fault (Fig. 6).

The structural evolution of deformation bands and fractures
Disaggregation bands typically form in a burial sequence prior to lithification (Fig. 8b), cataclastic deformation initiates with micromotion occurring (pressure and/or fluid flow), and lithification, displayed in Figure 3a. Cataclastic deformation bands exhibit an en echelon feature (Fig. 3b). Non-hydroxide cement in a post-deformation feature (Fig. 3d). Cement precipitation is promoted by highly reactive fresh surfaces resulting from calcite and diagenetic fibrocalcite cement precipitates. The open holes highlight the influence of the reverse fault stress regime that formed/Deformation Band Set 1. Deformation Band Set 2 is characterized by shear-enhanced cataclastic deformation bands exhibit a combination of high-resolution imagery analysis and conventional grid methods. Using a more conventional grid method, we measured 221 deformation bands in the Port Willunga Formation, which define four neotectonic generations of deformation bands (Fig. 5). Deformation bands increase moving towards the Willunga Fault (Fig. 6).

Summary
- 221 deformation bands in the Port Willunga Formation and 260 fractures in the Heathendale Shale directly relate to the neotectonic evolution of the Willunga Fault.

1. Fracture Set 3
2. Deformation Band Set 1 (DBS 1)
3. Deformation Band Set 2 (DBS 2)
4. Deformation Band Set 3 (DBS 3)
5. Deformation Band Set 4 (DBS 4)

5. Temporal evolution of the St. Vincent Basin

References: